

## ABSTRACT OF THE DISCLOSURE

A hydrometallurgical process utilizing an atmospheric calcium chloride leach to selectively recover from various metal feed stocks (consisting of elemental metals, metal oxides, metal ferrite, metal hydroxide, metal carbonates, metal sulfate/sulfur compounds, and their hydrates, specifically including but not limited to EAF Dust KO61) zinc, lead, cadmium, silver, copper and other valuable metals to the exclusion of iron, magnesium, halogen salts and other unwanted elements. The process solves the problem of iron and magnesium leach solution contamination because iron is unexpectedly converted to magnetite. The heavy metals are cemented out of solution using zinc or other selected dust at a pH of 6 or greater under unique and unexpected conditions, which do not require acid. Simonkolleite /zinc- oxychloride /zinc-hydroxide is produced from the purified zinc chloride complex pregnant leach solution and is converted directly to high purity active rubber grade 99+% zinc oxide having small particle size and high surface area. The products are metal concentrates suitable for: metal refiner/processors, production of elemental metal, or other conversion processes. The process removes Arsenic and Fluorides in the feed material. The process also solves the problem of chloride contamination in the zinc oxide and prevents heavy metal contaminants in the hydrometallurgically produced zinc oxide derived from feed stocks containing chlorides or when chlorides are used to leach the metal bearing feed stocks. In one embodiment, calcium and/or magnesium compounds are added to the iron bearing waste to increase the recovery of zinc and other non-ferrous metals and to produce an iron bearing flux. The process is environmentally friendly and fully recycles all streams.